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The views, opinions and/or findings contained in this report are those of the author(s) and should not contrued as an official Department of the Army position, policy or decision, unless so designated by other documentation.

14. ABSTRACT
New Mexico State University (NMSU) proposed acquisition of equipment to establish an integrated system for laser-assisted, non-intrusive experimentation and data-driven reduced-order modeling of multidisciplinary phenomena in structural and fluid dynamics. The system consists of three components: (i) a 1D scanning laser vibrometer for structural vibration tests; (ii) a 3D particle image velocimetry (PIV) system for experimental fluid dynamics; and (iii) a 3D scanner for computational mesh data. All these three components have been acquired and installed respectively in the designated laboratories, and are currently tested to build up an integrated system as

15. SUBJECT TERMS
Equipment acquisition, laser-assisted experimentation, data-driven model order reduction

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a. REPORT	b. ABSTRACT	c. THIS PAGE			Young Sup Lee
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Report Title

Final Report: Acquisition of an Integrated System for Laser-Assisted Non-Intrusive Experimentation and Data-Driven Reduced-Order Modeling

ABSTRACT

New Mexico State University (NMSU) proposed acquisition of equipment to establish an integrated system for laser-assisted, non-intrusive experimentation and data-driven reduced-order modeling of multidisciplinary phenomena in structural and fluid dynamics. The system consists of three components: (i) a 1D scanning laser vibrometer for structural vibration tests; (ii) a 3D particle image velocimetry (PIV) system for experimental fluid dynamics; and (iii) a 3D scanner for computational mesh data. All these three components have been acquired and installed respectively in the designated laboratories, and are currently tested to build up an integrated system as proposed. This integrated system assists the PI and key personnel in promoting a novel systematic methodology for data-driven (yet physics-based) reduced-order models of strongly nonlinear, unsteady, multidisciplinary and multiscale dynamics by means of analytical / empirical decomposition methods. The experimental system has been utilized to promote STEM education at NMSU by encouraging students' participation in research-oriented projects. The courses that benefited include ME 456 Experimental Modal Analysis, AE 447 / ME510 Aero/Fluids Laboratory, and ME 533 Computational Fluid Dynamics.

Enter List of papers submitted or published that acknowledge ARO support from the start of the project to the date of this printing. List the papers, including journal references, in the following categories:

(a) Papers published in peer-reviewed journals (N/A for none)

Received Paper

TOTAL:

Number of Papers published in peer-reviewed journals:

(b) Papers published in non-peer-reviewed journals (N/A for none)

Received Paper

TOTAL:

Number of Papers published in non peer-reviewed journals:

(c) Presentations

Number of Presentations: 0.00

Non Peer-Reviewed Conference Proceeding publications (other than abstracts):

Received Paper

TOTAL:

Number of Non Peer-Reviewed Conference Proceeding publications (other than abstracts):

Peer-Reviewed Conference Proceeding publications (other than abstracts):

Received Paper

TOTAL:

Number of Peer-Reviewed Conference Proceeding publications (other than abstracts):

(d) Manuscripts

Received Paper

TOTAL:

Number of Manuscripts:

Books

Received Book

TOTAL:

Received Book Chapter

TOTAL:

Patents Submitted

Patents Awarded

Awards

(1) Young Lee and Mingjun Wei received Research Achievement Award (for those who brought in sponsored grants in excess of $500,000) by the President of New Mexico State University (NMSU) and Vice President for Research (2014).

(2) Young Lee was nominated as an Outstanding Professor by the NMSU Mechanical and Aerospace Engineering Academy (2014)

(3) Mingjun Wei has been promoted to AIAA Associate Fellow (2015)

(4) Mingjun Wei received a titled professorship, called the MAE Academy Professor, from the College of Engineering at NMSU (2015)

Graduate Students

NAME	PERCENT_SUPPORTED
FTE Equivalent:	
Total Number:	

Names of Post Doctorates

NAME	PERCENT_SUPPORTED

FTE Equivalent:
Total Number:

Names of Faculty Supported

NAME	PERCENT_SUPPORTED

FTE Equivalent:
Total Number:

Names of Under Graduate students supported

NAME	PERCENT_SUPPORTED

FTE Equivalent:
Total Number:

Student Metrics

This section only applies to graduating undergraduates supported by this agreement in this reporting period

The number of undergraduates funded by this agreement who graduated during this period: 0.00

The number of undergraduates funded by this agreement who graduated during this period with a degree in science, mathematics, engineering, or technology fields:..... 0.00

The number of undergraduates funded by your agreement who graduated during this period and will continue to pursue a graduate or Ph.D. degree in science, mathematics, engineering, or technology fields:..... 0.00

Number of graduating undergraduates who achieved a 3.5 GPA to 4.0 (4.0 max scale):..... 0.00

Number of graduating undergraduates funded by a DoD funded Center of Excellence grant for Education, Research and Engineering:..... 0.00

The number of undergraduates funded by your agreement who graduated during this period and intend to work for the Department of Defense 0.00

The number of undergraduates funded by your agreement who graduated during this period and will receive scholarships or fellowships for further studies in science, mathematics, engineering or technology fields:..... 0.00

Names of Personnel receiving masters degrees

NAME

Total Number:

Names of personnel receiving PHDs

NAME

Total Number:

Names of other research staff

NAME	PERCENT_SUPPORTED

FTE Equivalent:
Total Number:

Sub Contractors (DD882)

Inventions (DD882)

Scientific Progress

It is still on-going to build up a perfectly working integrated system at NMSU for laser-assisted, non-intrusive experimentation and data-driven reduced-order modeling of multidisciplinary phenomena in structural and fluid dynamics. The system acquired consists of Polytec PSV-500 Scanning Vibrometer, LaVision 3D PIV System, and COMET L3D Laser Scanner System, respectively installed in the Aerospace Structural Dynamics Laboratory, the Wind-Tunnel Facility, and the Computational Fluid Dynamics Laboratory. All the three components have been rigorously used to promote research and STEM education at NMSU, which is summarized in the following.

(1) PSV-500 was used to assist modal testing for New Mexico Small Business Assistance Project, titled “David Bowers 1) Feasibility and Demonstration, and 2) Demonstration and Valiation,” in Summer 2014, and also in teaching ME 456 Experimental Modal Analysis in Fall 2014. It has contributed to one conference (ASME IDETC) and one journal (Quarterly of Applied Mathematics) papers that will be published by the end of 2015.

(2) LaVision 3D PIV System has been used to enhance the lab sessions of AE447 and ME510 courses. This system has also been included as major equipment in three proposals: "Experimental Study of Natural Ornithopters' Response to Flow Disturbances" (NSF CBET 1510690, declined); "Experimental Study of Gravity Driven Cards" (NSF CAREER 1454664, declined) and "Numerical and Experimental Investigation of the Fluid Dynamics of Flapping-Foil Hydro-Turbines" (NSF CBET 1436970, declined).

(3) COMET L3D Laser Scanner has been included to meet the equipment requirements for several research proposals: "Center for Robots and Autonomous Systems with Future Technologies (DoD, BAA# RIK-2014-0008, declined), “Tailored Metal Hydride and Innovative Reactor System for High Temperature Thermal Energy Storage” (DOE, APOLLO, FOA# DE-FOA-0001186, pending).

Technology Transfer